

Appl. No. : **09/883,851**
Filed : **June 18, 2001**

AMENDMENTS TO THE CLAIMS

Please add Claims 26-30, as indicated below.

A complete listing of all claims is presented below with insertions underlined (e.g., insertion), and deletions struckthrough or in double brackets (e.g., ~~deletion~~ or [[deletion]]):

1. (Original) A system for non-invasive stoichiometric detection and imaging of chemical elements and compounds in a material to be analyzed, the system comprising:
 - a particle generator, the particle generator generating a plurality of first subatomic particles and a plurality of second subatomic particles at a target position which is a first distance from the material to be analyzed;
 - at least one photon detector, the at least one photon detector being capable of detecting photons resulting from irradiation of the material to be analyzed by the first subatomic particles and generating a plurality of first electrical signals;
 - a particle detector array comprising a plurality of particle detectors, the detector array at a second distance from the target position, the second distance being larger than the first distance, the particle detectors each being capable of detecting at least one second subatomic particle from the particle generator, and generating a plurality of second electrical signals; and
 - an analyzer operatively connected to the particle detector array and the at least one photon detector, comprising:
 - a processor, the processor filtering the plurality of first electrical signals so as to produce a plurality of filtered electrical signals; and
 - a plurality of electronic coincidence circuits, the coincidence circuits detecting coincidences occurring between the plurality of filtered electrical signals and the plurality of second electrical signals.
2. (Original) The system of Claim 1, wherein the first subatomic particles comprise neutrons.
3. (Original) The system of Claim 1, wherein the second subatomic particles comprise alpha particles.
4. (Original) The system of Claim 1, wherein the particle detectors are electronically coordinated to produce a three dimensional electronic image of the material to be

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analyzed, the image corresponding to a plurality of imaged volume elements, whereby the image provides an average empirical chemical formula for each imaged volume element.

5. (Original) A system for detecting and imaging a chemical substance, comprising:

a particle source, the source generating a plurality of first subatomic particles and a plurality of second subatomic particles from a target position a first distance from the chemical substance, the first subatomic particles irradiating the chemical substance;

at least one photon detector capable of detecting photons resulting from the irradiation of the chemical substance by the first subatomic particles;

a particle detector array comprising a plurality of particle detectors, the particle detector array capable of detecting at least one second subatomic particle, the particle detector array at a second distance from the target position, the second distance larger than the first distance; and

an analyzer capable of detecting and imaging the chemical substance based on signals output from the at least one photon detector and the at least one particle detector.

6. (Original) The system of Claim 5, wherein the particle detectors are electronically coordinated to produce a three dimensional electronic image of the chemical substance, the image corresponding to a plurality of imaged volume elements, whereby the image provides an average empirical chemical formula for each imaged volume element.

7. (Original) The system of Claim 5, wherein the first subatomic particles comprise neutrons.

8. (Original) The system of Claim 7, wherein the neutrons have an energy level greater than or equal to 1 MeV.

9. (Original) The system of Claim 7, wherein the particle source comprises at least one target and at least one hydrogen isotope source which generates hydrogen isotopes, the particle source configured to impinge the hydrogen isotopes on the at least one target, thereby generating the neutrons.

10. (Original) The system of Claim 5, wherein the second subatomic particles comprise alpha particles.

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11. (Original) The system of Claim 10, wherein the at least one photon detector and the at least one particle detector are adapted to provide information regarding the position of the chemical substance relative to the system.

12. (Original) The system of Claim 5, wherein the photon detector comprises a Germanium crystal detector capable of detecting gamma rays.

13. (Original) The system of Claim 5, wherein the plurality of particle detectors comprise at least one scintillation detector.

14. (Original) The system of Claim 5, wherein the analyzer is adapted to detect coincidences between the particle detector and the photon detector.

15. (Original) The system of Claim 14, wherein the coincidences correspond to a plurality of spectral lines and the analyzer is further adapted to electronically process the detected coincidences to provide discrimination among the spectral lines.

16. (Original) The system of Claim 14, wherein the analyzer is further adapted to provide information regarding ratios of types of constituent atoms present in the chemical substance.

17. (Original) The system of Claim 16, wherein the types of constituent atoms include carbon, nitrogen, and oxygen.

18.-25. (Cancelled)

26. (New) A system for detecting and imaging a chemical substance, comprising:

a particle source, the source generating a plurality of first subatomic particles and a plurality of second subatomic particles from a target position, the plurality of first subatomic particles propagating along a set of first trajectories from the target position to the chemical substance, the plurality of second subatomic particles propagating along a set of second trajectories, wherein each second trajectory has a corresponding first trajectory of the set of first trajectories, the first subatomic particles irradiating the chemical substance;

at least one photon detector detecting photons resulting from the irradiation of the chemical substance by the first subatomic particles;

a particle detector array comprising a plurality of particle detectors, the particle detector array detecting the plurality of second subatomic particles generated from the

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target position, wherein each second trajectory is longer than the corresponding first trajectory; and

an analyzer capable of detecting and imaging the chemical substance based on signals output from the at least one photon detector and the at least one particle detector.

27. (New) The system of Claim 26, wherein the system further comprises a magnetic field which affects the second trajectories of the plurality of second subatomic particles.
28. (New) The system of Claim 27, wherein the magnetic field is non-focusing.
29. (New) The system of Claim 27, wherein the magnetic field is focusing.
30. (New) The system of Claim 26, wherein the second trajectories of the plurality of second subatomic particles comprise migma orbits.